


## manual change transmittal

TITLE DIVISION OF DESIGN HIGHWAY DESIGN MANUAL  SIXTH EDITION – CHANGE 09/28/11		APPROVED BY  TERRY L. ABBOTT, Chief	NO.  Date Issued: 09/28/11  Page 1 of 1
SUBJECT AREA Table of Contents; Chapters: 60, 80, 300, and Index		ISSUING UNIT  DIVISION OF DESIGN	
SUPERCEDES  SEE BELOW FOR SPECIFIC PAGE NUMBERS		DISTRIBUTION <b>ALL HOLDERS OF THE 6<sup>TH</sup> EDITION, HIGHWAY DESIGN MANUAL</b>	

The California Department of Transportation (Caltrans) has developed new high speed rail guidance in the Sixth Edition, Highway Design Manual (HDM). The high speed rail guidance has been provided in Chapters 60, 80, and 300, as included in this manual change transmittal. The changes are described in the summary below with change-sheets available on the Caltrans Design website at: <http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm>. These revisions and changes are effective September 28, 2011, and shall be applied to on-going projects in accordance with HDM Index 82.5 – Effective Date for Implementing Revisions to Design Standards.

HDM Holders are encouraged to use the most recent version of the HDM available on-line at the above website. Should a HDM Holder choose to maintain a paper copy, the Holder is responsible for keeping their paper copy up to date and current. Using the latest version available on-line will ensure proper reference to the latest design standards and guidance. If you would like to be notified automatically of any significant changes or updates to the HDM, go to <http://www.dot.ca.gov/hq/oppd/hdm/hdmlist.htm>.

A summary of the most significant revisions are as follows:

**Index 62.10**

**Users, Page 60-11**

New index provided to include the definition for high speed rail.

**Table 82.1B**

**Advisory Standards, Page 80-10**

The new High Speed Rail Clearance advisory standard located in Index 309.1 was added to the list of advisory standards.

**Index 309.1(1)**

**Horizontal Clearances, Page 300-20**

Guidance was expanded to consider horizontal clearance objectives to the planned ultimate traveled way width of the highway facility. Also a reference was added to new subsection (4) for high speed rail clearance guidance.

**Index 309.1(4)**

**High Speed Rail Clearances, Page 300-22**

New high speed rail clearance guidance has been provided. Included is the new advisory standard for horizontal clearance when a high speed rail corridor is to be constructed longitudinally to a freeway, expressway or a conventional highway with posted speeds over 40 mph.

Enclosures available on the Department Design website at: <http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm>.

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- (c) **Traffic Signal**--A power-operated control device by which traffic is warned or directed to take a specific action. These devices do not include signals at toll plazas, power-operated signs, illuminated permanent markers, warning lights, or steady burning electric lamps.
- (14) **Volume**. The number of vehicles passing a given point during a specified period of time.
- (15) **Weaving**. The crossing of traffic streams moving in the same general direction accomplished by merging and diverging.
- (16) **Ramp Metering**. A traffic management strategy which utilizes a system of traffic signals on freeway entrance and connector ramps to regulate the volume of traffic entering a freeway corridor in order to maximize the efficiency of the freeway and thereby minimize the total delay in the transportation corridor.

## 62.9 Drainage

See Chapter 800 for definition of drainage terms.

## 62.10 Users

- (1) **High Speed Rail**. A type of intercity and interregional passenger rail service that operates significantly faster than conventional rail. Top operating speeds are typically 150 to 220 miles per hour. These trains may be powered by overhead high voltage lines or technologies such as Maglev. The tracks are grade separated within a separate controlled access right of way and may or may not be shared with freight trains.



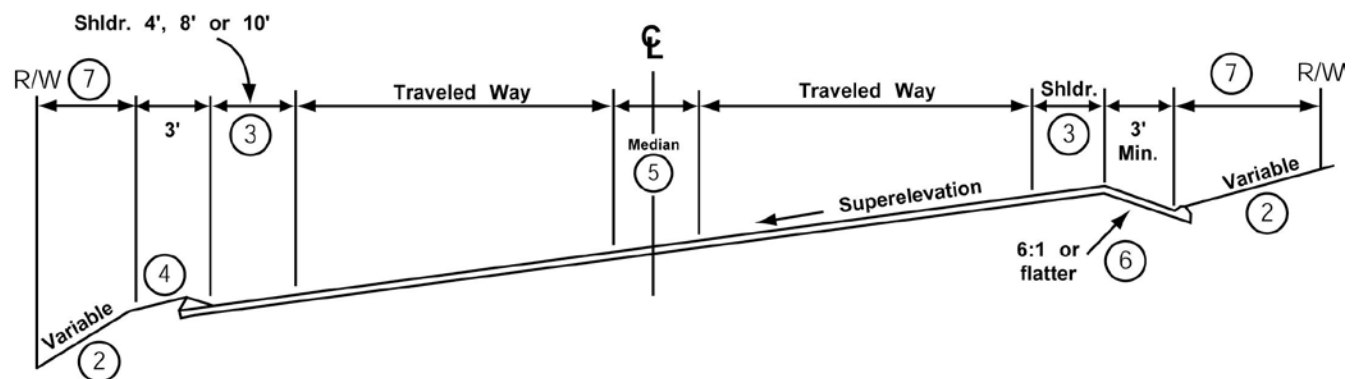
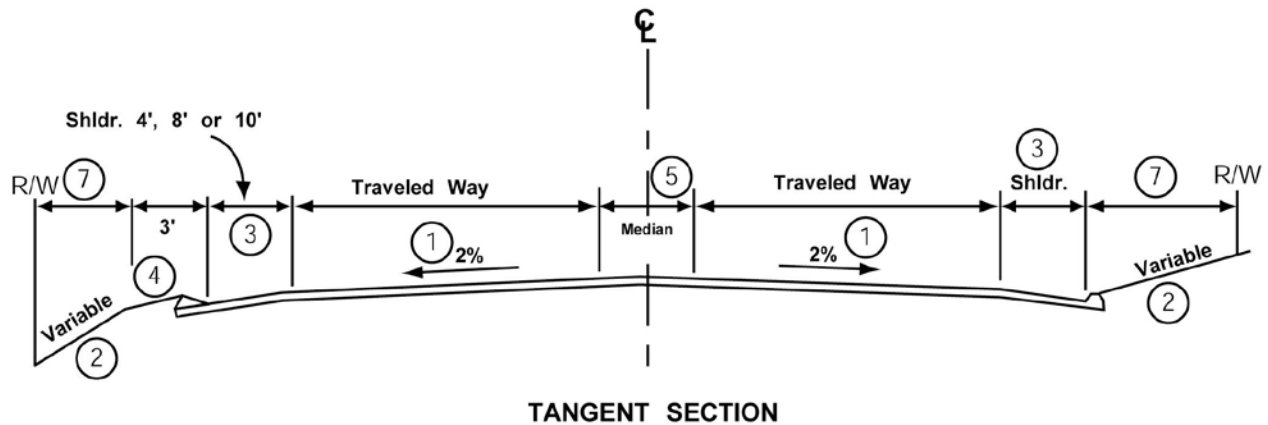
**Table 82.1B**  
**Advisory Standards**

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	202.5	Superelevation Runoff		208.10	Bicycle Railing Locations
	202.5	Superelevation in Restrictive Situations		<b>Topic 210</b>	<b>Earth Retaining Systems</b>
	202.6	Superelevation of Compound Curves		Index 210.5	Cable Railing
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**Table 82.1B**  
**Advisory Standards (Cont.)**

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<b>Topic 303</b>		<b>Curbs, Dikes, and Side Gutters</b>		404.3 California Legal Design Vehicle Accommodation
Index	303.1	Use of Curb with Operating Speeds of 45 mph and Greater		404.3 45-Foot Bus & Motorhome Design Vehicle
	303.1	Selection of Curb Type	<b>Topic 405</b>	<b>Intersection Design Standards</b>
	303.3	Selection of Dike Type	Index	405.1 Corner Sight Distance at Public Road Intersections
<b>Topic 304</b>		<b>Side Slopes</b>		405.1 Decision Sight Distance at Intersections
Index	304.1	Side Slopes 4:1 or Flatter		405.5 Emergency Openings and Sight Distance
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Index	309.1	Clear Recovery Zone		504.2 Auxiliary Lanes
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<b>Topic 403</b>		<b>Principles of Channelization</b>		
Index	403.3	Angle of Intersection		

**Figure 307.5**  
**Geometric Cross Sections for**  
**All Paved Multilane Highways**



**SUPERELEVATION SECTION**

**NOTES**

①	CROSS SLOPES	See Index 302.2
②	SIDE SLOPES	See Index 304.1
③	SHOULDER	See Index 307.5
④	DIKES	See Index 303.3
⑤	MEDIANS	See Index 305.1 (3)
⑥	SIDE GUTTERS	See Index 834.3 (3)
⑦	RIGHT OF WAY	See Index 306.1

It is important to note that AASHTO, A Policy on Geometric Design of Highways and Streets, standards are based on functional classification and not on a Federal-aid System.

Chapter 1 of AASHTO, A Policy on Geometric Design of Highways and Streets, list standards for the following six functional classes:

- Local rural roads
- Local urban streets
- Rural collectors
- Urban collectors
- Rural arterials
- Urban arterials

AASHTO, A Policy on Geometric Design of Highways and Streets, gives minimum lane and shoulder widths. When selecting a cross section, the effects on capacity of commercial vehicles and grades should be considered as discussed under Topic 102 and in the Transportation Research Board, Highway Capacity Manual.

**The minimum width of 2-lane overcrossing structures shall not be less than 28 feet curb to curb.** Also see Index 208.1(2) and Index 307.3.

If the local agency has definite plans to widen the local street either concurrently or within 5 years following freeway construction, the reconstruction to be accomplished by the State should generally conform to the widening planned by the local agency. Stage construction should be considered where the planned widening will occur beyond the 5-year period following freeway construction or where the local agency has a master plan indicating an ultimate width greater than the existing facility. Where an undercrossing is involved, the initial structure construction should provide for ultimate requirements.

**Where a local facility crosses over or under a freeway or expressway and connects to the State facility (such as ramp terminal intersections), the minimum design standards for the cross section of the local facility shall be at least equal to those for a conventional highway with the exception that the outside shoulder width shall match the approach roadway, but not less than 4 feet (shoulder width should not be less than 5 feet where curbs with 2-foot gutter pans are**

proposed and bicycle use is expected). **The minimum width for two-lane overcrossings at interchanges shall be 40 feet curb-to-curb.**

## Topic 309 - Clearances

### 309.1 Horizontal Clearances

- (1) *General.* The horizontal clearance to all roadside objects should be based on engineering judgment with the objective of maximizing the distance between roadside objects and the edge of traveled way. Engineering judgment should be exercised in order to balance the achievement of horizontal clearance objectives with the prudent expenditure of available funds.

Certain yielding objects, such as sand filled barrels, metal beam guardrail, breakaway wood posts, etc. may encroach within the clear recovery zone (see Index 309.1(2)). While these objects are designed to reduce the severity of accidents, efforts should be made to maximize the distance between any object and the edge of traveled way.

Clearances are measured from the edge of the traveled way to the nearest point on the obstruction (usually the bottom). Consideration should be given to the planned ultimate traveled way width of the highway facility. **Horizontal clearances greater than those cited below under subsection (3) - "Minimum Clearances" shall be provided where necessary to meet horizontal stopping sight distance requirements.** See subsection (4) for high speed rail clearance guidance. See discussion on "... technical reductions in design speed..." under Topic 101.

- (2) *Clear Recovery Zone (CRZ).* The roadside environment can and should be made as safe as practical. A clear recovery zone is an unobstructed, relatively flat (4:1 or flatter) or gently sloping area beyond the edge of the traveled way which affords the drivers of errant vehicles the opportunity to regain control. The AASHTO Roadside Design Guide provides detailed design guidance for

creating a forgiving roadside environment. See also Index 304.1 regarding side slopes.

The following clear recovery zone widths are the minimum desirable for the type of facility indicated. Consideration should be given to increasing these widths based on traffic volumes, operating speeds, terrain, and costs associated with a particular highway facility:

- Freeways and Expressways – 30 feet
- Conventional Highways – 20 feet\*

\* On conventional highways with posted speeds less than or equal to 40 mph and curbs, clear recovery zone widths do not apply. See minimum horizontal clearance, Index 309.1(3)(c).

Fixed objects including bridge piers, abutments, retaining walls, and noise barriers closer to the edge of traveled way than the distances listed above should be eliminated, moved, redesigned to be made yielding, or shielded in accordance with the following guidelines:

- (a) Fixed objects should be eliminated or moved outside the clear recovery zone to a location where they are unlikely to be hit.
- (b) If sign posts six inches or more in any dimension or light standards cannot be eliminated or moved outside the clear recovery zone, they should be made yielding with a breakaway feature.
- (c) If a fixed object cannot be eliminated, moved outside the clear recovery zone, or modified to be made yielding, it should be shielded by guardrail or a crash cushion.

Shielding must be in conformance with the guidance found in Chapter 7 of the Traffic Manual. For input on the need for shielding at a specific location, consult District Traffic Operations.

When the planting of trees is being considered, see the additional discussion and standards in Chapter 900.

**Where compliance with the above stated clear recovery zone guidelines are impractical, the minimum horizontal clearance cited below shall apply to the unshielded fixed object. These minimum horizontal clearances apply to yielding objects as well.**

(3) *Minimum Clearances.* The following minimum horizontal clearances shall apply to all objects that are closer to the edge of traveled way than the clear recovery zone distances listed above:

- (a) The minimum horizontal clearance to all objects, such as bridge rails and safety-shaped concrete barriers, as well as sand-filled barrels, metal beam guardrail, etc., on all freeway and expressway facilities, including auxiliary lanes, ramps, and collector roads, shall be equal to the standard shoulder width of the highway facility as stated in Table 302.1. A minimum clearance of 4 feet shall be provided where the standard shoulder width is less than 4 feet. Approach rail connections to bridge rail may require special treatment to maintain the standard shoulder width.
- (b) The minimum horizontal clearance to walls, such as abutment walls, retaining walls in cut locations, and noise barriers on all facilities, including auxiliary lanes, ramps and collector roads, shall not be less than 10 feet.
- (c) On conventional highways, frontage roads, city streets and county roads (all without curbs), the minimum horizontal clearance shall be the standard shoulder width as listed in Tables 302.1 and 307.2, except that a minimum clearance of 4 feet shall be provided where the standard shoulder width is less than 4 feet. For RRR projects, widths are provided in DIB 79.

On conventional highways with curbs, typically in urban conditions, a minimum horizontal clearance of 1 foot 6 inches should

be provided beyond the face of curbs to any obstruction. On curbed highway sections, a minimum clearance of 3 feet should be provided along the curb returns of intersections and near the edges of driveways to allow for design vehicle offtracking (see Topic 404). Where sidewalks are located immediately adjacent to curbs, fixed objects should be located beyond the back of sidewalk to provide an unobstructed area for pedestrians.

In areas without curbs, the face of Type 60 concrete barrier should be constructed integrally at the base of any retaining, pier, or abutment wall which faces traffic and is 15 feet or less from the edge of traveled way (right or left of traffic and measured from the face of wall). See Index 1102.2 for the treatment of noise barriers.

The minimum width of roadway openings between Temporary Railing (Type K) on bridge deck widening projects should be obtained from the District Permit Engineer.

The Regional Permit Manager should be consulted on the use of the route by overwidth loads.

See Chapter 7 of the Traffic Manual for other requirements pertaining to clear recovery zone, guardrail at fixed objects and embankments, and crash cushions.

- (4) *High Speed Rail Clearances.* When a high speed rail corridor is to be constructed longitudinally to a freeway, expressway or a conventional highway with posted speeds over 40 mph, the nearest fixed object or feature associated with the operation of the rail facility should be located a minimum of 52 feet horizontally from the planned ultimate edge of the traveled way. See Index 62.10 for the definition of high speed rail. The terrain and the required highway features between the edge of traveled way and the rail facility to be constructed must be evaluated to determine on a case-by-case basis whether or not shielding behind guardrail, barrier or other safety device in conformance with the guidance found in Chapter 7 of the Traffic Manual is needed. For input on the need for shielding at a

specific location, consult District Traffic Operations.

## 309.2 Vertical Clearances

### (1) *Major Structures.*

(a) Freeways and Expressways, All construction except overlay projects – **16 feet 6 inches shall be the minimum vertical clearance over the roadbed of the State facility (e.g., main lanes, shoulders, ramps, collector-distributor roads, speed change lanes, etc.).**

(b) Freeways and Expressways, Overlay Projects – **16 feet shall be the minimum vertical clearance over the roadbed of the State facility.**

(c) Conventional Highways, Parkways, and Local Facilities, All Projects – **15 feet shall be the minimum vertical clearance over the traveled way and 14 feet 6 inches shall be the minimum vertical clearance over the shoulders of all portions of the roadbed.**

- (2) *Minor Structures.* **Pedestrian over-crossings shall have a minimum vertical clearance 2 feet greater than the standard for major structures for the State facility in question.**

**Sign structures shall have a vertical clearance of 18 feet over the roadbed of the State facility.**

- (3) *Rural Interstates and Single Routing in Urban Areas:* This subset of the Interstate System is composed of all rural Interstates and a single routing in urban areas. Those routes described in Table 309.2B and Figure 309.2 are given special attention in regards to minimum vertical clearance as a result of agreements between the FHWA and the Department of Defense. **Vertical clearance for structures on this system shall meet the standards listed above for freeways and expressways.** In addition to the standards listed above, vertical clearances of less than 16 feet over any portion of this system will be subjected to extensive review by FHWA and must be approved by the Military Traffic Management Command Traffic Engineering Agency

(MTMCTEA) in Washington D. C. Documentation in the form of a Design Exception Fact Sheet must be submitted to FHWA to obtain approval for less than 16 feet of vertical clearance. Vertical clearances of less than 16 feet over any Interstate will require FHWA/MTMCTE notification. See Robert L. Buckley's memo dated March 30, 2000 to District Directors for more information on this subset of the Interstate system.

- (4) *General Information.* The standards listed above and summarized in Table 309.2A are the minimum allowable on the State Highway system for the facility and project type listed. For the purposes of these vertical clearance standards, all projects on the freeway and expressway system other than overlay projects shall be considered to be covered by the "new construction" standard.

When approved by a design exception (see HDM Index 82.2) clearances less than the values given above may be allowed on a case by case basis given adequate justification based upon engineering judgment, economic, environmental or right of way considerations. Typical instances where lesser values may be approved are where the structure is protected by existing lower structures on either side or where a project includes an existing structure that would not be feasible to modify to the current standard. In no case should vertical clearance be reduced below 15 feet over the traveled way or 14 feet 6 inches over the shoulders over any portion of a State highway facility.

Efforts should be made to avoid decreasing the existing vertical clearance whenever possible and consideration should be given to the feasibility of increasing vertical clearance on projects involving structural section removal and replacement. Any project that would reduce vertical clearances below 16 feet 6 inches or lead to an increase in the vertical clearance should be brought to the attention of the Design Coordinator, the District Permit Engineer and the Regional Permit Manager at the earliest possible date.

The Regional Permit Manager should be informed of any changes (temporary or permanent) in vertical clearance.

- (5) *Federal Aid Participation.* Federal-aid participation is normally limited to the following maximum vertical clearances unless there are external controls such as the need to provide for falsework clearance or the vertical clearance is controlled by an adjacent structure in a multi-structure interchange:

(a) Highway Facilities.

- 17 feet over freeways and expressways.
- 15 feet 6 inches over other highways (15 feet over shoulders).
- For pedestrian structures, 2 feet greater than the above values.

(b) Railroad Facilities.

- 23 feet over the top of rails for non-electrified rail systems.
- 24 feet 3 inches over the top of rails for existing or proposed 25 kv electrification.
- 26 feet over the top of rails for existing or proposed 50 kv electrification.

These clearances include an allowance for future ballasting of the rail facility. The cost of reconstructing or modifying any existing railroad-highway grade separation structure solely to accommodate electrification will not be eligible for Federal-aid highway fund participation. Where a rail system is not currently electrified, the railroad must have a plan adopted which specifies the intent to electrify the subject rail segment within a reasonable time frame in order to provide clearances in excess of 23 feet.

Any exceptions to the clearances listed above should be reviewed with the FHWA early in the design phase to ensure that they will participate in the structure costs. All excess clearances should be documented in the project files as to reasons and appropriate concurrences.

**Table 309.2A**  
**Vertical Clearances**

	<b>Traveled Way</b>	<b>Shoulder</b>
Freeways and Expressways, New Construction, Lane Additions, Reconstruction and Modification	16½ ft	16½ ft
Freeways and Expressways, Overlay Projects	16 ft	16 ft
All Projects on Conventional Highways and Local Facilities	15 ft	14½ ft
Sign Structures	18 ft	18 ft
Pedestrian and Minor Structures	Standard + 2 ft See 309.2(2)	
Structures on the Rural and Single Interstate Routing System	See 309.2(3)	

### 309.3 Tunnel Clearances

- (1) *Horizontal Clearances.* Tunnel construction is so infrequent and costly that the width should be considered on an individual basis. For the minimum width standards for freeway tunnels see Index 309.1.

Normally, the minimum horizontal clearance on freeways should include the full roadbed width of the approaches.

**In one-way tunnels on conventional highways the minimum side clearance from the edge of the traveled way shall be 4 feet 6 inches on the left and 6 feet on the right. For two-way tunnels, this clearance shall be 6 feet on each side.**

- (2) *Vertical Clearances.* **The minimum vertical clearance shall be 15 feet measured at any point over the traveled way and 14 feet 6 inches above the gutter at the curb line. On freeways and expressways, the vertical clearance listed in Index 309.2(1)(a) shall be used.** Cost weighed against the probability of over-height vehicles will be the determining factors.

### 309.4 Lateral Clearance for Elevated Structures

Adequate clearance must be provided for maintenance, repair, construction, or reconstruction of adjacent buildings and of the structure; to avoid damage to the structure from a building fire or to buildings from a vehicle fire; to permit operation of equipment for fire fighting and other emergency teams. **The minimum horizontal clearance between elevated highway structures, such as freeway viaducts and ramps, and adjoining buildings or other structures, shall be 15 feet for single-deck structures and 20 feet for double-deck structures. Spot encroachments on this clearance shall be approved in accordance with Index 82.2.**

### 309.5 Structures Across or Adjacent to Railroads

Regulations governing clearances on railroads and street railroads with reference to side and overhead

structures, parallel tracks, crossings of public roads, highways, and streets are established by the PUC.

- (1) *Normal Horizontal and Vertical Clearances.* Although General Order No. 26-D specifies a minimum vertical clearance of 22 feet 6 inches above tracks on which freight cars not exceeding a height of 15 feet 6 inches are transported, a minimum of 23 feet should be used in design to allow for reballasting and normal maintenance of track. Railroads on which freight cars are not operated, should have a minimum vertical clearance of 19 feet. In establishing the grade line, the District should consult the DES to obtain the depth of structures and false work requirements, if any (see Index 204.6(4)).

At underpasses, General Order No. 26-D establishes a minimum vertical clearance of 14 feet above any public road, highway or street. **However, the greater clearances specified under Index 309.2 shall be used.**

All curbs, including median curbs, should be designed with 10 feet of clearance from the track centerline measured normal thereto.

The principal clearances which affect the design of highway structures and curbs are summarized in Tables 309.5A and B. It should be noted that collision walls may be required for the clearances given in Columns (3) and (4) of Table 309.5B. Usually, no collision walls are required if the clearance 10 feet or more on tangent track and 11 feet or more on curved track.

**Table 309.5A  
Minimum Vertical Clearances  
Above Highest Rail**

Type of Structure	Type of Operation	
	Normal Freight	No Freight Cars Operated
Highway overhead and other structures including through railroad bridges.	23' – 0"	19' – 0"

- (2) *Off-track Maintenance Clearance.* The 18-foot horizontal clearance is intended for sections of railroad where the railroad company is using or definitely plans to use off-track maintenance equipment. This clearance is provided on one side of the railroad right of way.

On Federal-aid projects, where site conditions are such that off-track maintenance clearance at an overpass is obtained at additional cost, Federal-aid funds may participate in the costs of such overhead designs that provide up to 18 feet horizontal clearance on one side of the track. In such cases, the railroad is required to present a statement that off-track maintenance equipment is being used, or is definitely planned to be used, along that section of the railroad right of way crossed by the overhead structure.

- (3) *Walkway Clearances Adjacent to Railroads.* All plans involving construction adjacent to railroads should be such that there is no encroachment on the walkway adjoining the track. Walkway requirements are set forth in General Order No. 118 of the PUC. Where excavations encroach into walkway areas, the contractor is required to construct a temporary walkway with handrail as set forth in the contract special provisions.

- (4) *Approval.* All plans involving clearances from a railroad track must be submitted to the railroad for approval as to railroad interests. Such clearances are also subject to approval by the PUC.

To avoid delays, early consideration must be given to railroad problems when design is started on a project.

## Topic 310 - Frontage Roads

### 310.1 Cross Section

Frontage roads are normally relinquished to local agencies. When Caltrans and a county or city enter into an agreement (cooperative agreement, freeway agreement, or other type of binding agreement), the CTC may relinquish to the county or city any

frontage or service road or outer highway within that city or county. The relinquished right of way (called a collateral facility) should be at least 40 feet wide and have been constructed as part of a State highway project, but not as a part of the main State highway. Index 308.1 gives width criteria for city streets and county roads. These widths are also applicable to frontage roads. **However, the minimum paved cross section for urban frontage roads shall be two 12-foot lanes with 4-foot outside shoulders.** See Chapter 1000 for shoulder requirements when bicycles are present. **The minimum paved cross section for rural frontage roads shall be 24 feet.**

### 310.2 Outer Separation

In urban areas and in mountainous terrain, the width of the outer separation should be a minimum of 26 feet from edge of traveled way to edge of traveled way. A greater width may be used where it is obtainable at reasonable additional cost, for example, on an urban highway centered on a city block and paralleling the street grid.

In rural areas, other than mountainous terrain, the outer separation should be a minimum of 40 feet wide from edge of traveled way to edge of traveled way.

See Figure 307.4 for cross sections of outer separation and frontage road.

### 310.3 Headlight Glare

Care should be taken in design of new frontage roads to avoid the potential for headlight glare interfering with the vision of motorists traveling in opposite directions on the frontage roads and in the outer freeway lanes. The preferred measures to prevent headlight glare interference on new construction are wider outer separations, revised alignment and raised or lowered profiles.

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